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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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## FULL CONTENTS

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### [Claim(s)]

[Claim 1] The barrel which has a material feed opening (4), a vent mouth (5), and an air extraction opening (3), And the material in which a flight outer diameter contains a fine granular material using the said direction rotation 2 axis extrusion machine which has a fixed screw is set to the method of carrying out extrusion molding over the whole region of this barrel. (I) In a downstream barrel, a vent mouth (5) from a material feed opening (4) again An air extraction opening (3) is installed in an upstream barrel from a material feed opening (4), respectively. (II) Compress material into the barrel between a material feed opening (4) and a vent mouth (5). The 2 axis extrusion-molding method of the material containing the fine granular material characterized by carrying out melting, and carrying out extrusion molding, discharging the volatile component included in material from a vent (III) mouth (5), and discharging the air included by material from (IV) air extraction opening (3).

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the extrusion-molding method of using a said direction rotation 2 axis extrusion machine. It is related with the method of carrying out extrusion molding, extracting the air included in the material which contains in detail the fine granular material supplied in a barrel from the material feed opening of a said direction rotation 2 axis extrusion machine.

[0002]

[Description of the Prior Art] A said direction rotation 2 axis extrusion machine has mixture of an extrudate and good dispersibility, and since the stable throughput rate is obtained, it is widely used as an extrusion machine of much material.

[0003] When carrying out extrusion molding of the plastic material with which it sees from the former and specific gravity contains small fine granular material resin or a fine granular material so much, the material in an extrusion machine feed section eats, and the amount of lumps limits a throughput rate in many cases.

[0004] The method of supplying an extrudate to an extrusion machine as a means to solve this, for example using a compulsive feed unit (compactor) is adopted.

[0005] However, even if it uses a compactor, when it sees by very fine particles and specific gravity

carries out extrusion molding of the small powdered material, the effect is not perfect, it is difficult to obtain a desired throughput rate by being stabilized, and it necessary to operate on the extrusion conditions of the limited range.

[0006] [ thus, the greatest factor which has barred the eat lump in the extrusion machine feed section of the material containing a fine granular material ] The appearance specific gravity of a fine granular material is a lot of air included by it because it is small. Within an extrusion machine, compress, and melting of the material having contained this air is carried out, and it separates air. It is to check solid transportation of the material which contains a fine granular material within a barrel, as a result of the separated air flowing into the move direction and contrary of material by the side of a material feed opening (i.e., the inside of a barrel), and for this material to mobilize within the barrel near the material feed opening further. Therefore, the solid transport capacity of material and the transport capacity to a screw which it eats, the amount of lumps is restricted and a screw originally has are not fully demonstrated.

[0007] Also in this case, since melting of material advances by heating from the shearing force on a screw, and a barrel, an extrusion operation is not lost, but since the solid transport capacity which a screw has is not fully demonstrated, only far low capability can be demonstrated compared with the original throughput rate which an extrusion machine has.

[0008] As a method of solving this problem, the air extraction extrusion method of fine granular material of using for a downstream barrel the completeness engagement type said direction 2 axis extrusion machine which prepared the opening for discharging the air included by the extrudate is proposed by JP,H2-1650,B from the material feed opening, for example.

[0009] However, this method is the method of separating and discharging only the air included by the extrudate, only when an opening is prepared in the region which has an extrudate in a half-molten state. That is, when an opening is prepared in the region in which fine granular material material is discharged with air and which has an extrudate in a perfect molten state when an opening is prepared in the region which has an extrudate in a non-molten state (powdered voice), air is not discharged out of a system but flows backwards to a feed opening.

[0010] Therefore, carry out in consideration of [ making easy to discharge from an opening according to the kind of extrudate the air included by material ] the combination of a screw segment etc., and a screw design is changed. And it is not a method desirable as a method which also needs to change operating conditions, such as extrusion temperature and extrusion speed, needs to set up the process condition corresponding to an extrudate, and carries out extrusion molding of the extrudate of varieties using the same extrusion machine.

[0011]

[Problem to be solved by the invention] Even if the purpose of this invention solves the above-mentioned problem and an extrudate changes, do not need change in a screw design so that the air included by material may be made easy to discharge from an opening. When carrying out extrusion molding of the material which contains a fine granular material using a said direction rotation 2 axis extrusion machine, it is in offering the 2 axis extrusion-molding method which aims at increase of a throughput rate, is moreover stabilized, and can do extrusion molding.

[0012]

[Means for solving problem] As a result of inquiring wholeheartedly, by preparing the opening for discharging air in the upper stream side of the material feed opening of a said direction rotation 2 axis

extrusion machine, this invention persons found out that the above-mentioned purpose could be attained, and resulted in this invention.

[0013] Namely, the barrel which has a material feed opening (4), a vent mouth (5), and an air extraction opening (3) by this invention, And the material in which a flight outer diameter contains a fine granular material using the said direction rotation 2 axis extrusion machine which has a fixed screw is set to the method of carrying out extrusion molding over the whole region of this barrel. (I) In a downstream barrel, a vent mouth (5) from a material feed opening (4) again An air extraction opening (3) is installed in an upstream barrel from a material feed opening (4), respectively. (II) Compress material into the barrel between a material feed opening (4) and a vent mouth (5). The 2 axis extrusion-molding method of the material containing the fine granular material characterized by carrying out extrusion molding is offered carrying out melting, discharging the volatile component included in material from a vent (III) mouth (5), and discharging the air included by material from (IV) air extraction opening (3).

[0014] The feature of this invention installs an air extraction opening in the barrel located in the upper stream side from a material feed opening among the above-mentioned composition, and there is in discharging the air included by the extrudate from this opening out of a system.

[0015] Since the above-mentioned air extraction opening of this invention is installed in the barrel by the side of the upper stream of a material feed opening, it can define the installation position regardless of the position which an extrudate fuses. Therefore, even if it changes an extrudate into the thing of other type, it is not necessary to change the air included by material into the screw design which is easy to discharge from an opening.

[0016] Therefore, it is preferably used for what is called the pellet fabrication method or the tablet fabrication method of carrying out melting extrusion of the method of carrying out extrusion molding of the extrudate of varieties using the same extrusion machine, for example, the powder material, and fabricating to a grain and cylindrical \*\* etc.

[0017] This invention is explained in detail hereafter. There is no restriction in particular in the kind of said direction rotation 2 axis extrusion machine used for this invention, and the model generally marketed is used. For example, IKEGAI Make, a completeness engagement type said direction rotation 2 axis extrusion machine, formal;PCM-45, the Toshiba Machine Co., Ltd. make, a completeness engagement type said direction rotation 2 axis extrusion machine, formal;TEM-50 type, the Toshiba Machine Co., Ltd. make, a completeness engagement type said direction rotation 2 axis extrusion machine, formal;TEM-100 type, etc. are illustrated.

[0018] An extrudate applicable to the 2 axis extrusion-molding method of this invention is divided roughly, and the following two kinds are mentioned. That is, the constituent with which thermoplastics, thermosetting resin, those mixtures or other organic matters, and 2 fine granular material are inorganic substances, and the material containing 1 fine granular material mixed this inorganic substance to thermoplastics, thermosetting resin, those mixtures, or other organic matters can be illustrated.

[0019] Although there is no restriction in particular in the particle size of the above-mentioned fine granular material, it is preferably applicable to the extrusion molding of the extrudate which contains the fine particles whose average particle sizes are about 1-50 micrometers ten to 100weight %, for example.

[0020] When carrying out extrusion molding of the extrudate which there is no restriction in the extrusion temperature which carries out this invention, for example, makes thermoplastics the main ingredients, this resin should just be the temperature range which will be in melting or a softening state and shows mobility. Moreover, when carrying out extrusion molding of the extrudate which makes

thermosetting resin the main ingredients, what is necessary is just the temperature range which this resin will be in melting or a softening state, and shows mobility, and causes a hardening reaction.

[0021] Specifically, for example Polyethylene, polypropylene, a polyether ether ketone, When carrying out extrusion molding of the extrudate which makes crystalline thermoplastics, such as polyimide and polyethylene terephthalate, the main ingredients, more than the melting point (henceforth  $T_m$ ) of this resin carries out preferably in the temperature range of under decomposition temperature.

[0022] When carrying out extrusion molding of the extrudate which makes the main ingredients amorphous thermoplastics, such as polyvinyl chloride, polystyrene, poly ether SURUFON, and polycarbonate, more than the glass transition temperature (henceforth  $T_g$ ) of this resin carries out preferably in the temperature range of under decomposition temperature.

[0023] Moreover, when carrying out extrusion molding of the extrudate which makes the main ingredients thermosetting resin, such as phenol resin, an epoxy resin, urea resin, and melamine resin, it carries out preferably in [ temperature ] about 50-250 degrees C.

[0024] Next, the method of this invention is explained based on Drawings. [ Drawing 1 ] is an example of the mimetic diagram showing the section of the said direction rotation 2 axis extrusion machine used for this invention.

[0025] In [ drawing 1 ], two screws 2 are rotating in this direction mutually with the diameter of said covering full length in the barrel 1 of an extrusion machine. The air extraction opening 3 is directly linked with the barrel by the side of the upper stream of the material feed opening 4, and is installed. The vent mouth 5 is directly linked with the barrel by the side of the lower stream of the material feed opening 4, and is installed. The kneading part 6 of a screw 2 is installed between the material feed opening 4 and the vent mouth 5. An extrudate is fused and kneaded in the kneading part 6.

[0026] The extrudate supplied into the barrel 1 from the material feed opening 4 is conveyed by the screw 2, and is completely fused in the kneading part 6 by shearing generation of heat by the shearing force of a screw 2, and the heat transfer from a barrel 1. The seal of the air included by the extrudate is carried out in a fusion zone 6, and it is not sent to the lower stream side from this part, but is discharged from the air extraction opening 3 installed by flowing backwards in the direction of the material feed opening 4, and linking the inside of an extrusion machine with the barrel 1 by the side of the upper stream of the material feed opening 4 directly. Therefore, the material within the barrel near the material feed opening does not flow, but the throughput rate of extrusion machine original can be obtained, without blocking the solid transport capacity on a screw 2.

[0027] Although the method in particular of discharging the air included by the extrudate from the air extraction opening 3 is not restricted, generally it should just only open the opening 3 wide.

[0028] [ a different point of the air extraction opening in this invention, and the air extraction opening conventionally indicated by well-known, for example, JP,H2-1650,A, ] The installation position is in the point whether it is in the lower stream side from a material feed opening, or to be in the upper stream side, and the effect of the increase in a throughput rate is acquired, without needing change of a screw design so that the air included by material in this invention may be made easy to discharge more easily than an opening etc.

[0029] The air extraction opening 3 in this invention is directly linked with the barrel 1 by the side of the upper stream of the material feed opening 4, and is installed. When installing in the position nearest to the material feed opening 4, you may install adjacently so that the nozzle of the material feed opening 4 and the nozzle of the air extraction opening 3 may touch. Moreover, when installing in the most distant

position from the material feed opening 4, a mutual distance between centers is installed in the upper stream side equivalent to about 10 times of the diameter of a barrel. Even if it installs in the position exceeding this, there is no difference in the air extraction effect, but since a barrel becomes long, it is not desirable.

[0030] The form of an air extraction opening does not interfere with a cylindrical shape or an rectangular pipe form, either. Moreover, if the size of the opening is a caliber which is the grade by which the air included by material is discharged, there will be no restriction in particular, but generally it is good at the size grade of the size grade of the vent mouth usually used to a material feed opening. When the jacket for cooling etc. is installed in the barrel, it is installed in the position which naturally avoided it.

[0031] As mentioned above, although discharge of the air included by the extrudate was explained, this invention is not applied only to discharge of this air, and is applied also to discharge of inactive gas, such as nitrogen used for the substitution in a system.

[0032]

[Working example] Hereafter, a work example is shown and this invention is explained still more concretely.

a work-example 1 completeness engagement type said direction rotation 2 axis extrusion machine extrusion machine (IKEGAI Make and formal;PCM45 and diameter of barrel;45mmphi --) Barrel length; The air extraction opening (distance between centers of a material feed opening and an air extraction opening; 405mm) of 80mm of diameters phi is prepared in the barrel by the side of the upper stream of 1575mm and the material feed opening of L/D;35 of a screw. Moreover, the 15x25mm vent mouth (distance between centers of a material feed opening and a vent mouth; 785mm) was prepared in the barrel by the side of the lower stream of the material feed opening of this 2 axis extrusion machine.

[0033] A fixed quantity of feed units were used for the material feed opening of the above-mentioned 2 axis extrusion machine, at the temperature of 400 degrees C, screw rotation speed was 100rpm and extrusion molding of the thermoplastic polyimide resin (the Mitsui Toatsu Chemicals, Inc. make, brand name;AURUM, a mean particle size; 8-13 micrometers) was carried out.

[0034] The air by which it was contained in the extrudate in the inside of extrusion molding was discharged from the air extraction opening, and fine powdered material did not blow off from this part. Moreover, the volatile component contained in the extrudate was discharged by attracting a vent mouth using the exhaust, without accompanying fine powdered material. As a result, it became throughput-rate 30 kg/hr and the stable extrusion molding was possible.

[0035] Extrusion molding of the distance between centers of a work-example 2 material feed opening and an air extraction opening was carried out like the work example 1 except having been referred to as 135mm. As a result, it became throughput-rate 30 kg/hr and the stable extrusion molding was possible.

[0036] Extrusion molding of the comparative example 1 air-extraction opening was carried out like the work example 1 except having prepared immediately after the fusion zone of the barrel by the side of the lower stream of a material feed opening. As a result, the extrudate carried out full fusion by the upper stream side from the air extraction opening, and the air contained in an extrudate was not discharged from an air extraction opening. The maximum throughput rate was 15 kg/hr.

[0037] Extrusion molding was carried out like the work example 1 except not having prepared a comparative example 2 air-extraction opening. The maximum throughput rate was 15 kg/hr.

[0038]

[Effect of the Invention] According to this invention, extrusion molding can be carried out extracting the

air contained in the material containing a fine granular material, and increase of a throughput rate can be aimed at. And even if an extrudate changes, it is not necessary to change into the design of a screw so that the air included by material may be made easy to discharge from an opening, and it is the flexibility extrusion-molding method inexpensive in equipment.

[0039] Therefore, it is the extrusion-molding method that various resin etc. can be especially utilized for the method of carrying out pelletizing fabrication etc. using the same extrusion machine.

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[Brief Description of the Drawings]

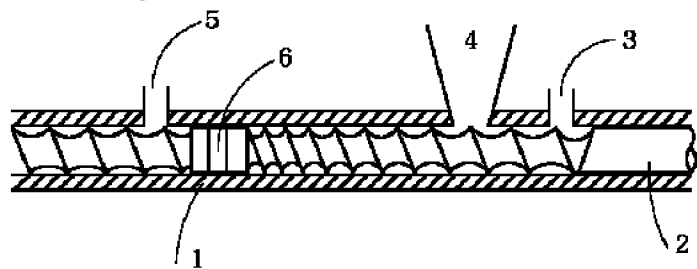
[Drawing 1] An example of the mimetic diagram showing the section of the said direction rotation 2 axis extrusion machine used for \*\*\*\*\* is shown.

[Explanations of letters or numerals]

- 1 Barrel
- 2 Screw
- 3 Air Extraction Opening
- 4 Material Feed Opening
- 5 Vent Mouth
- 6 Kneading Part

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[Drawing 1]



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[Translation done.]